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ABSTRACT

Drawing from personal experiences in the development of an interactive testing program for a sociology course, this paper discusses issues related to the use of computer-based education in social science classes. First, the paper describes the steps taken by the Community College of Denver to introduce interested faculty to the possibilities of computer-based education (i.e., soliciting formal proposals for the development of computer-assisted or computer-managed instructional techniques; awarding release time or overload pay to implement proposals; installing and staffing a computer laboratory; and providing readings, orientation workshops, and training to familiarize teachers with computer technology). The paper also focuses on the process of developing the interactive testing program, explaining facets of screen design and writing utility programs. The use of the program in an open-entry/open-exit course design is detailed, indicating that students were required to read learning objectives in their Study Guide, read the textbook, fill in an "active-reading guide" in the Study Guide, take a self-test, view a videotape associated with each unit, take a tutorial in the computer lab, and take chapter quizes using the interactive testing program. The paper then considers how coursework was evaluated, the role of the instructor, and the results of the lack of class/group interaction. Final sections of the paper consider problems such as the low completion rate and student complaints concerning the difficulty of the course and the lack of interaction with the teacher and other students; and the benefits of the computer-managed instruction for students and the teacher. (RO)

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DEVELOPING COMPUTER BASED EDUCATION AND SELF-PACING FOR INTRODUCTORY SOCIOLOGY: A TEACHER'S PERSPECTIVE

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DEVELOPING COMPUTER BASED EDUCATION AND SELF-PACING FOR INTRODUCTORY SOCIOLOGY:

A TEACHER'S PERSPECTIVE

In 1982, the Community College of Denver received a Title III grant to improve student retention at the college. One of the missions stated in the proposal was to introduce faculty, staff, and students to the possibilities of computer-based education. The award of this grant turned our small college upside down and and generated a flurry of activity in educational innovation.

We were the classical example of sudden wealth to an educational institutions to be spent for computer technology.[1] The investment in hardware and software was quick and tremendous. We were floating in a sea of microcomputers, their peripherals, and software within two or three months. The administration had already decided that we were going to be a part of the technological future and provided us with the tools to participate. So this was a "top-down" project, not highly recommended by the best authorities on the subject of educational innovation, but expedient in our case (Chorover,1984). To their credit, and with great insight into the natural conservatism of professors, who love their talking-teacher, textbook, chalk-board methods,

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[1]See "Can Educational Technology have any significant impact on Education?" Griffin, W. H. Technological Horizons in Education, Vol.11 (3) Nov. 1983: 96-99 for a more complete discussion of some of the consequences of instant "computerization".

(Griffin, 1983; Rockart and Morton, 1975) the administration also provided numerous incentives to the faculty to work on expanding their instructional design with the use of computers. Interested faculty were called upon to write formal proposals for educating themselves in CBE and for using or creating computer-assisted or computer-managed instructional techniques. The proposals were reviewed by committee and several faculty were awarded release time or overload pay to implement their proposals. A staff of programmers were hired and a computer lab was installed with a knowledgeable director. Such support and incentives are crucial to the development of educational innovation in the area of computer implementation (Grossnickle and Laird, 1983).

One of the college's primary interests was in the development of self-paced, individualized instruction. As with most community colleges, our clients are working adults, many of whom need great flexibility from our college to accomodate their busy lives. In the increasingly frustrating competition for enrollments among post-secondary schools, it is the potential adult-student who has been heavily targeted lately by even the most established, traditional university systems. Though the adult-learner has always been the most frequent consumer of the community college, our brethren from other higher educational institutions are making inroads into this pool of adult enrollments. In terms of competition for eager students, the Community College of Denver has the added disadvantage (advantage?) of being housed with two autonomous state-supported four-year colleges on the

same downtown campus. One can only imagine the fierce competition for the magic FTE (full-time equivalent) figures among the three colleges, and the re-writing of Mission Statements that goes on.

Enters now on this organizational stage the faculty player: a full-time professor of Sociology who received her graduate degree at the height of the Vietnam War, when Sociology was "in". Now, in 1985, it has lost its drawing power to those fields with more concrete and familiar employment potential like Business or Computer Data Management. As one student quipped, "What do I do with a Sociology degree? Open up a Sociology store?" Sociology has been dropped from the lists of required courses in post-secondary education (along with other liberal arts/ humanities type courses) with such regularity that some faculty are convinced there is a deliberate conspiracy to eliminate their jobs. Not wanting to risk the label "paranoid", we sublimate these fears and instead speak out against the decline in well-roundedness among our graduates. Does the systems-analyst know anything about human relations? What of art, history, the well-tempered English sentence?

Meanwhile, we social scientists scramble for bodies in our classrooms. In a rare cooperative and interdisciplinary mood I applied for release-time to develop some computer-based design for Introductory Sociology that could be used in a self-paced format. No conviction of the usefulness of computers in instruction motivated my impetuosity - nor any soul-searching evaluation

that there was a need to improve my course. It was a decision based on survival. Maybe self-pacing would draw more students, and the "hook" was high-tech: "Learn Sociology and become computer-literate at the same time!" Little did I know at the time how it would change my life.

There were prescribed steps that awarded faculty had to take on their road to innovation. The first step required was a review of the literature - a sort of consciousness-raising task for faculty interested in CBE (computer-based education). We read many journal articles about computers in education and did computer searches for available articles and software. We were expected to familiarize ourselves with how "good" CAI (computer-assisted instruction) was written, and what functions CMI (computer-managed instruction) could undertake in our classes. Then we pored over catalogue descriptions of software. It was a time of information overload, where the term "Information Age" took on new meaning to us.

At the same time we were expected to become "computer literate", a term that has idiosyncratic definitions in every arena. For us it meant:

1. being able to write a complete sentence using microcomputer terms correctly;

2. knowing how to boot a disk, run the program, and extract the disk from the micros without destroying the $500 software included thereon;

3. and acquiring some familiarity with the "procedural reasoning" required in programming.

The computer lab at our school offered weekly workshops in all facets of microprocessors (except for maintenance) to interested administrators, faculty, and staff. This is an absolutely essential part of any attempt to encourage faculty in innovation development. Faculty must have easy access to competent training in the use of computers for there to be any progress made in introducing CBE into their classes. Not only were workshops held on many topics, with hands-on training, they were free, offered at convenient times, and some of the more intensive ones offered continuing-education graduate credit hours. The whole history of microcomputer implementation by faculty at the Community College is marked by phenomenal support on the part of the administration and staff.

For the faculty who were given release time to develop CBE, there was further training into how to write "frames", or "screens", and how to talk intelligently to the computer programmers. For those faculty who have the urge to familiarize themselves with computer technology for the classroom, but who fear they don't have the scientific background, I can assure you that the above prescription suggested to us is sufficient. You need not be a physicist, or even have had one single "A" grade in a mathematics course to become a competent user of micros in your classroom.

After reviewing the literature and becoming familiar with microcomputers (their advantages and disadvantages), the next step in the process was applying this knowledge to what might be practical for course use. I decided, as a neophyte, that to pursue computer-assisted instruction in its more complex modes such as tutorials, simulations, or games would be foolhardy at my level of expertise. I began with the more simple application of computer-managed instruction, though I did purchase an interactive tutorial program written for the textbook I was using in Introductory Sociology.[2] This tutorial program offers students multiple choice questions by chapter, and when the wrong answer is chosen by the student, a paragraph of further information is displayed on the screen before a second try at the question is offered. A second wrong answer refers the student to a page in the book for further reading. How I incorporated this into a self-paced design is explained later.

The CMI application chosen for the self-paced Introductory Sociology course was an interactive-testing program. This program was written in BASIC by a computer programmer assigned to assist me. It will randomly select objective questions for each user from a question bank, and record scores and other information for use by the instructor. My responsibility was the design of each screen display that the program offers. Every test question entered requires a separate display, therefore the screens

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[2]This program is called CADE and was written by Isaac Robinson.

to be described merely for the questions numbered over four hundred. But the screen displays for the test questions were fairly simple as every display was identical- just the words were different. The creative aspect required was the positioning of the question on the screen, keeping the question and multiple choice answers short enough to prevent "scrolling" of a single question, deciding whether questions should be numbered, and what size type should be used. Writing the program in BASIC added two small but influential bugs to the composing of questions. The comma is a program command and therefore could not be used in any text. Nor could quotation marks appear at the beginning of any question for the same reason. These restrictions challenged the writing skills of this teacher and called for some very creative grammatical structure.

The most creativity in screen design occurred at the beginning of the program with the title "pages", student instructions, statistics gathering of students' names, social security numbers, dates, and chapter quiz menu. If you are not familiar with display design or storyboard writing, you would not believe the multitude of decisions one must make to produce a visually aesthetic and conceptually coherent interactive program. All the well-studied interpersonal communication and social-psychology research done in my graduate training was put to practical application to a greater extent that ever before. I debated over most soothing colors, habituation potentials, cognitive schema, visual breakpoints, cue salience, etc. We intend eventually to add

music to the beginning of the program. This also will require much sociological and psychological consideration. Some suggestions from my more amusing colleagues are the "Jaws" music when the shark was about to attack, the beginning of Beethoven's Fifth Symphony for a dramatic effect, or in a lighter vein, The Dance of Hours by Ponchielli.

Beyond the screen display work, there were many hours spent on writing the "utility" programs that the instructor uses for entering, checking, and altering questions. There were utility programs for gathering student scores, printing hardcopy and softcopy of both questions and student records. Each program had to be reworked many times not only for its display qualities, but with an eye to facile manipulation by a first-time computer-user, be it a student or an instructor.

I would like to editorialize a bit here about the term "user-friendliness". Among the many jargon words now in vogue for computer-users, I find this one the most descriptive, unlike "baud-rate" or "ms dos", to mention just a few.[3] There is also much to be said for the concept of "user-friendliness" as well. Copy machines I have known through my life have never been "user-friendly". They intimidate me with their complexity and the need to practically take a three credit course of instruction on their operation. To this day, I would rather have someone

[3]In general though, much of the computer rhetoric is very descriptive and appropriate. One needs only to compare the physicists labels for forces in the universe, i.e. "strong force", "weak force", to get a real appreciation for terms like "menu-driven" and "goto".

else make copies for me on any copy machine. Call it a learning disability, if you will, but I am Xerox-illiterate.

Part of "user-friendliness" is the "menu-driven" capacity of computer programs. "Menu-driven" is my favorite technological breakthrough, and is the friendliest thing about any computer program. If only my interpersonal interactions were menu-driven, I might make fewer faux-pas, or could at least "escape" when the situation was hopeless and "re-boot" for another try.

The utility programs we wrote for the instructor's use, then, were scrutinized closely for clear instructions, and provide all manner of checkpoints and re-do options.

It is estimated that a single hour of CAI programming requires about 100 hours of preparation (Gottlieb and Borodin, 1973:152). I believe this to be underestimated for the individual who begins such a task without knowing anything about computers. Faculty awarded release time for the development of CBE at our college were required to keep a log accounting for their hours. If one includes the information research time, and the microcomputer workshops attended, the development of one hour of this CMI interactive testing program took me 184 hours, and this CMI program is a relatively simple form of computer application to instruction. Also the hours do not include the programmer's time spent in programming, time spent by computer-lab personnel in training me, or time spent developing the other components of self-paced Introductory Sociology.

Contemporaneously with the review and purchase of the CADE tutorial program and the development of the testing program, there were other activities involved in creating a self-paced course namely, the development of instructional materials and the organizational design.

One of the goals for this course design was to make it "open-entry" and "open-exit", that is, students could enroll in the class at any time during the semester, and finish the course at any time within two semesters. Computerizing a tutorial and testing component for the course provided the logistics for individual pacing, but only managed the more "rote" aspects of course design. The content of the course had still to be written and the method of information dissemination described. Requiring regular lecture attendance was not feasible given our targeted population, i. e. those students whose work schedules would not accomodate the more traditional course requirements. Although a traditional lecture course in Introductory Sociology was scheduled every semester, attendance at these lectures was optional for students who registered for the self-paced section. Self-paced students were provided with alternative materials and methods to supplement their learning.

There was a required textbook, and a large study-guide workbook. The workbook was written for the text by another instructor at our college (Valvatne, 1980) and provides numerated learning objectives for each chapter and an "active-reading" guide requiring the student to fill-in blanks as he or she reads

through the textbook. At the end of every chapter in the workbook certain synthesizing questions are asked to help students integrate some of their reading. Also provided is a self-test for each chapter, with the answers and the page number where students can find the information.

In addition students were expected to watch a half-hour videotape for each instructional unit. These were professionally produced videotapes for use by Introductory Sociology students. The tapes were available for viewing at our campus library media center at any time during library hours. But this was not the only place students could view them. Our classroom building generally has videomonitors stationed in about ten to fifteen locations. These monitors are equipped with a telephone leading directly to the media center. Students need only to find an unoccupied monitor, pick up the phone, order the tape by call number (provided in the students' information packet), and settle back with earphones on while the tape is played for them.

Thus we have a "high-tech" presentation of material, utilizing as many media forms as we could. There is print material, video/audio material, and computerized material. The student is required to read, write, view, listen, and punch a keyboard. With luck, the brain will be drafted into use also.

The general form of the course design for students went something like this:

Step 1. Read Learning Objectives for chapter in Study Guide.

Step 2. Read chapter in textbook.

Step 3. While reading chapter fill in "active-reading guide" in Study Guide.

Step 4. Take self-test in Study Guide.

Step 5. View videotape associated with unit. (This step could be anywhere in the procedure depending on student preference.)

Step 6. Take CADE tutorial in computer lab.

Step 7. Take chapter quiz on CART interactive-testing program.

Step 8. OPTIONAL. Attend lecture. (This also could be anywhere in the procedure depending on student preference).

REPEAT STEPS FOR EACH CHAPTER[4]

Three important considerations remain. One, how is student coursework noted and evaluated? Two, has the teacher been supplanted? And three, what happens to the learning that is a product of class/group interaction?

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[4]In BASIC this might read as a FOR-NEXT loop; in LOGO, a REPEAT (8); in Pascal, a procedure with a FOR-DO prefix. One of the contraindications to learning about computers is the "reformatting" of all one's cognitions into a "flow-chart" system, and thinking in the programming language just as one who is learning any foreign language might do. In the middle of a very intensive course in Pascal programming I wrote a letter to my mother and unconsciously formed my salutation as:

Dear Mother,

Begin

The first question regarding recording and evaluating student work was easily handled. The computer tutorial and test kept exact records of student use (with dates and times) and scores. Personnel at the library kept a log of videotape requests by student name. The study guide was turned in periodically for evaluation. For the instructor it meant gathering data on students at regular intervals, noting them in the student's files, and occasionally making phone calls or sending letters to the slower members of the class in an effort to encourage continued progress. The self-pacing works very well for those who are self-starters but more than half the students required some gentle prodding. Those who were managing to stay on the suggested time line were also phoned and written encouraging messages.

Among the many details one must arrange for a self-paced class is an orientation for students. Orientation times were stated in the class schedule. They were offered on two successive days at the beginning of the semester, in the morning, afternoon, and evening for ninety minutes each. Students could attend the orientation time of their choice. At these orientations the design was explained. They were given a tour of the facilities, instructed in the use of the microcomputers and videomonitors, and shown where the disks and monitors were located. Students who took advantage of the "open-entry" clause and therefore registered later in the semester were given personal orientations by the instructor.

The second question regarding the supplanting of the teacher is a common fear of educators when thinking about CBE (Norris, 1985;Chorover, 1984). Much attention was paid to this issue. The teacher's role as course designer, assigner, and evaluator is obviously not supplanted by a computer-managed self-paced course. All of the teacher's pedagogical skills and knowledge of the discipline are used in the development of instructional materials. It is in the Study Guide that the teacher's function as director of learning is most utilized, and with practice these skills are sharpened. For example, an analysis of student progress, scores, and course-evaluations has led to reconsideration of the "active-reading" guide. This activity represents too much "busy work" for the amount of learning it produces, so if the self-paced Sociology course continues, the guide will be replaced with alternative materials. Synthesizing and application questions will be provided with each chapter, and a bibliography of pertinent journal articles and book chapters will be provided for each chapter.

The guide will include extra material about the writing of abstracts, how to do library research, attitude questionnaires for the students to take and score themselves to teach not only a little of methods, but a little of statistics as well, or at least to familiarize the student with the jargon in a more applied way. An essay or two will be assigned requiring the comparison of one or two theories to a subject such as Deviance.

Recently the college has established a special self-paced lab.[5] Journal articles and books will be kept in the lab for student use as they are assigned in the study guide. The self-paced lab also has tape cassettes and recorders for audio materials, a videomonitor with phone hook-up, study carrels, and typewriters.

But a faculty member is not just the producer/manager of a course. He or she is also a vital resource for the student. For this reason self-paced faculty hold office hours in the lab at least five hours a week, or by appointment, for face-to-face interaction with their students. For those students who avail themselves of all these resources there is some very personalized education going on.

The greatest problem remaining to computer-managed, self-paced instruction is the loss of group interaction learning. This can be a very important component to one's educational experience (Stanford and Roark, 1974; Bouton and Garth, 1983; Jernstedt, 1983). Although students may optionally attend regularly scheduled lectures, many cannot avail themselves of this experience. If they could, they probably wouldn't register for a self-paced course. One semester we offered three or four evening/weekend two-hour sessions to self-pacers. These were not well attended. At the moment we are struggling with this issue in our self-paced courses, considering all suggestions. Some

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[5]Many of our liberal arts courses were self-paced during the life of the Title III grant. There are history, english, and art courses offered in this format, therefore it appeared to be necessary to set up such a lab for the number of students enrolled.

self-paced students suggested the formation of study/discussion groups among themselves, so we are considering providing names and phone numbers of each registered student to the others (with their permission of course), with a suggestion that they form such groups.

Alterations and improvements in the computer-based, self-paced course are presently at a standstill though as we evaluate what we have learned regarding the effectiveness of such courses. In the beginning, I hoped it would increase enrollment in Sociology by offering alternative ways to the non-traditional student. The enrollment statistics compared before and after the offerings of this self-paced course do not support my expectations. Indeed, enrollments in Introductory Sociology continue to decline steadily through the years that we have offered the self-paced course.

Statistics gathered on the successful completion rate for self-pacers are dismal. In each semester some 30 to 50 percent of students were unable to complete the self-paced course. Given a second semester, the non-completion rate fell to about 20 percent, but this is still too large to be acceptable.

Student evaluations of the course were mixed, as usual. The most common complaint was the difficulty of the course because of the need to be one's own monitor. Many students would let the work slide until it was too late to complete in the prescribed time. I suspect that some students signed up for a self-paced course believing it to be an "easier road" to the three credits,

and then were surprised at the amount of time they had to commit to the course.

The second most common complaint was the lack of group interaction and/or teacher interaction. Though both were available to students in various ways, most did not seek out this interaction even though they felt deprived of it. It may be human nature to complain about the lack of something while making no attempts to acquire it.

But our experiment with Introductory Sociology involved many major innovations in its method. Not only was it self-paced, it was computer-assisted and computer-managed. Evaluations regarding these components of the course were quite different from those concerning the self-pacing aspects.

In general, students believed that the tutorial program (CADE) was helpful for preparation in testing. (Whether it was actually helpful in understanding concepts goes untested at the moment.) And when asked about their satisfaction with being tested by a computer, there were no "dissatisfied" scores. Students particularly like the computer's ability to give instant feedback on their efforts. The fate of self-paced Sociology is undecided at this time: it appears to have a terminal disease. But the use of the computer for some aspects of our traditional lecture course will probably increase. There are several advantages to the use of an interactive testing program for schools which have the facilities to manage it. I would like to discuss a few of these.

First, the testing program can be edited at the teacher's will. New questions can be added, old ones deleted, badly-worded ones improved with a minimum of effort on the instructor's part. The instructor can do it himself/herself, or use clerical help with a savings in typing and copying time. One needn't run off a new batch of tests for every midterm or final you give. Moreover, changing a textbook is easier because entering new questions is easier. Some authoring systems allow an automatic read-in of an already prepared disk containing a test bank. Many textbook publishers are offering their test banks on disks. Your random access, interactive program could automatically read in a new set of questions. Second, the random selection cabability of the computer insures that each individual student will get a different form of the test. This aspect severely inhibits cheating. Third, students may take the exams whenever it is convenient for them (within the lab hours, and the given time the teacher prescribes) without taking up precious class time for exams. Fourth, the interactive program gives the student feedback right away on their scores, and of course, relieves the teachers (or their assistants) of the tedium of test-scoring. The gradebook is kept for the instructor and is always current. It is probably more complete than the old-fashioned notebook gradebook we all have been keeping for years. Some computer gradebooks give dates and times for each test taken, questions missed, and running averages for student scores. Each student record can be represented graphically and might allow the instructor to see improvements or declines with visual ease.

As far as I know, there isn't a computer program which will evaluate and/or score an essay test. Yet it is still my favorite form of testing, even in Introductory courses. But the time it takes to grade essay tests has severely cut into the number of tests I can offer to students throughout the semester. Short objective exams (offered in the computer lab) could be required in addition to the major essay exams and would provide more opportunities for students to receive grades, to practice their learning skills, and improve their studying by giving early feedback to them.

I mentioned at the beginning that the process of developing innovations in Sociology changed my life. The changes wrought were many. In addition to adding myriad words to my vocabulary, and possible altering my cognitive processes, studying computers made me a "hacker" for the first year of the grant. My friends and family were forgotten for long periods of time while I "played" on my computer. Research into the effectiveness of computer-based education encouraged my return to graduate school to give full-time attention to this question for the following year. Subsequently, I became convinced that there is, as of yet, no good evidence that the computer is a "better" learning deliverer than a teacher, a textbook, a television, etc. (Clark, 1985; Salomon, 1984; Lepper, 1985). The issue of computer-aided instruction's role in education is a complex one, with controversial reports on the value of learning from a computer. But that is another subject altogether.

It appears obvious that there is a useful place for computer- managed instruction in education. The computer is an efficient, time-saving and inexpensive teacher's assistant. It will streamline many of the boring tasks that an instructor does and provide extra time for the more satisfying work in our job descriptions. And I will continue to read tirelessly the research being conducted on its most practical applications in the classroom.

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